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JAN 75 O R SMITH

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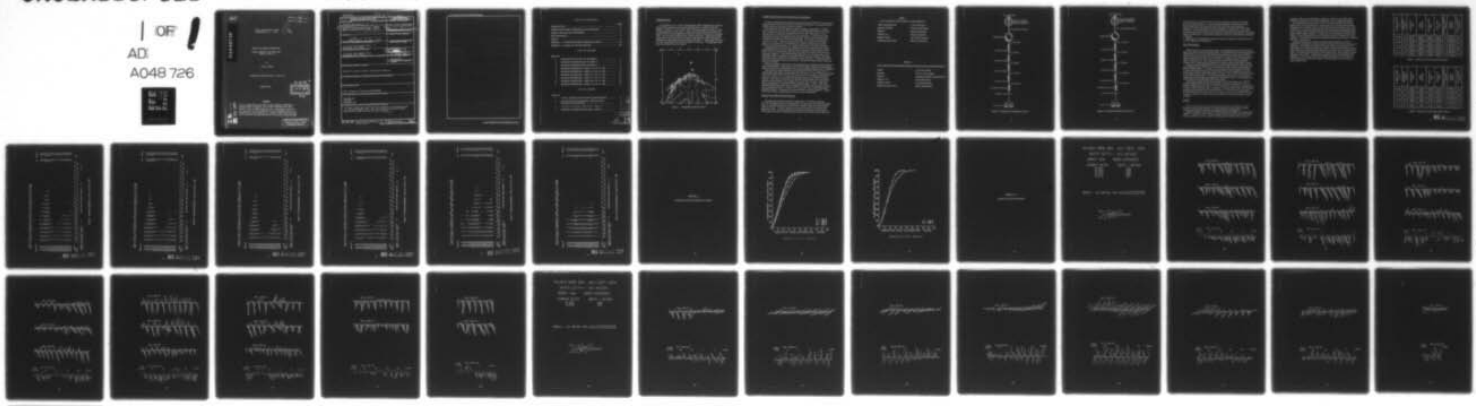

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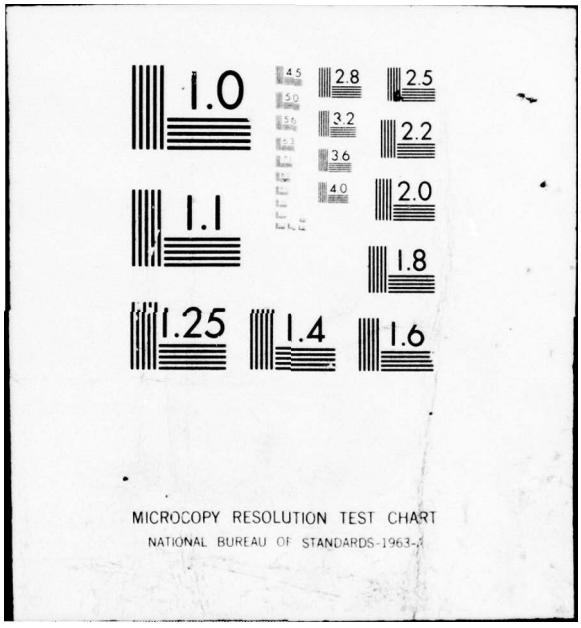
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RESULTS OF CURRENT OBSERVATIONS

WILKES NORWEGIAN SEA OPERATIONS (ARRAYS 3 AND 4)

BY

OTIS R. SMITH

NAVOCEANO TECHNICAL NOTE NO. 6110-2-75

JANUARY 1975

ABSTRACT

Current measurements were made in four separate locations at various depths in support of the WILKES Norwegian Sea Operations in July through September 1974. Measurements from the two locations in the Northern part of the Norwegian Sea will be reported on in this publication. Speeds at both locations were low to moderate with maximum values of 39 cm/sec being recorded.

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Gives current data collected at two locations in the Norwegian Sea July through September 1974. Data are reported in cumulative speed distribution graphs and graphs of vector averages.

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TABLE OF CONTENTS

	Page
INTRODUCTION	1
CURRENT METER ARRAY COMPONENTS AND HARDWARE	2
IMPLANT AND RECOVERY PROCEDURES	2
DATA PROCESSING	6
RESULTS	6
APPENDIX A - CUMULATIVE SPEED DISTRIBUTION GRAPHS	A-1
APPENDIX B - GRAPHS OF VECTOR AVERAGES	B-1

LIST OF FIGURES

Figure No.		
1	GEOGRAPHIC LOCATION OF THE ARRAYS	1
2	SCHEMATIC REPRESENTATION OF ARRAY 3	4
3	SCHEMATIC REPRESENTATION OF ARRAY 4	5
4	BIVARIATE DISTRIBUTION - ARRAY 3, C/M N - 507	9
5	BIVARIATE DISTRIBUTION - ARRAY 3, C/M N - 500	10
6	BIVARIATE DISTRIBUTION - ARRAY 3, C/M N - 273	11
7	BIVARIATE DISTRIBUTION - ARRAY 3, C/M N - 512	12
8	BIVARIATE DISTRIBUTION - ARRAY 4, C/M N - 504	13
9	BIVARIATE DISTRIBUTION - ARRAY 4, C/M N - 290	14

LIST OF TABLES

Table No.		
1	A-101-1 CURRENT METER PHYSICAL CHARACTERISTICS	3
2	AMF MODEL 322 TRANSPONDER / RELEASE DEVICE PHYSICAL CHARACTERISTICS	3
3	SUMMARY OF CURRENT METER DATA - ARRAY 3	8
4	SUMMARY OF CURRENT METER DATA - ARRAY 4	8

INTRODUCTION

In July 1974, the U.S. Naval Oceanographic Office implanted four tautlined arrays of self-contained current measuring instruments in Support of Exercise WILKES - NORWAY. Only Arrays 3 and 4 will be discussed here (Arrays 1 and 2 will be discussed in a later report). Arrays 3 and 4 were bottom anchored in 413 and 345 meters of water respectively on 28 July 1974 and retrieved on 4 September 1974. The two arrays consisted of four current meters each. Usable data records numbered four for Array 3 and two for Array 4 (see section on Data Processing for discussion on malfunctioning of two meters for this array.). Implantation and recovery were accomplished from the USNS WILKES (TAGS-33). The geographic location of the arrays is shown in Figure 1.

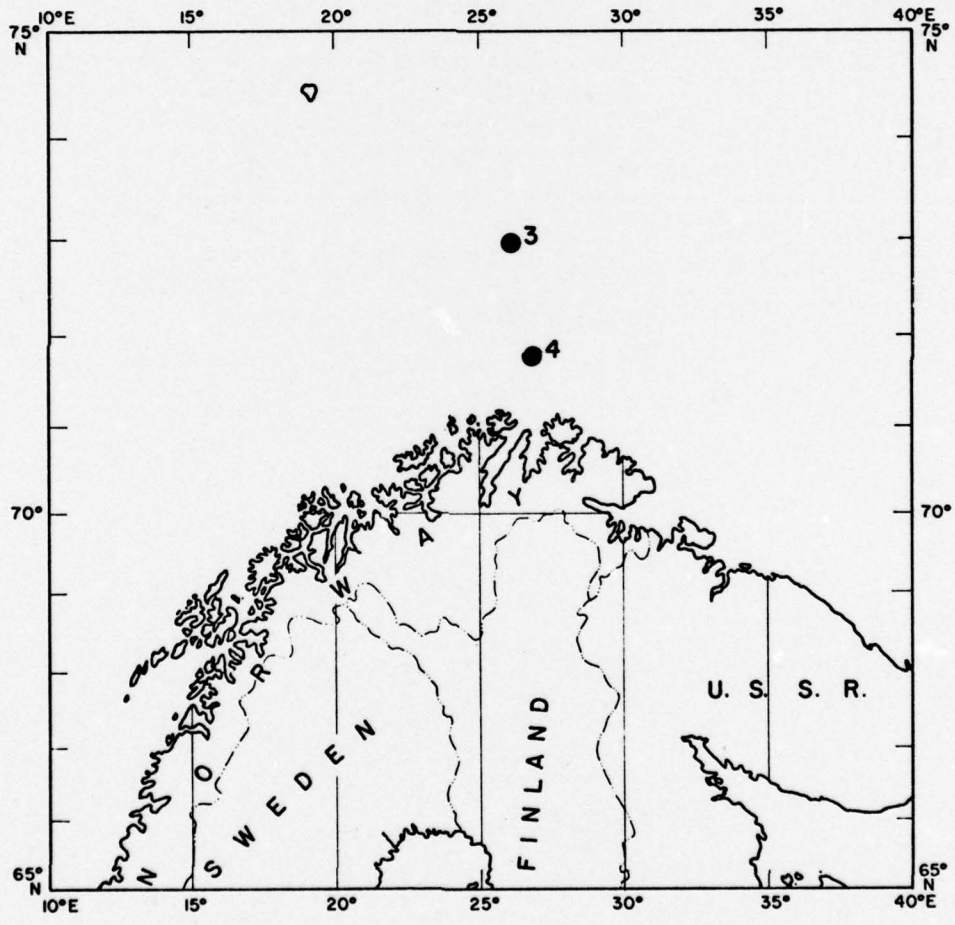


Figure 1. Geographic location of Arrays

CURRENT METER ARRAY COMPONENTS AND HARDWARE

Current measurements were obtained using eight Geodyne Model A-101 type current meters manufactured for NAVOCEANO by EG&G International. The physical characteristics of the current meters are shown in Table 1.

These instruments are self-contained, digital recording current meters. All data were recorded on a 38 meter (125 ft) reel of 16 mm Kodak 2496 RAR (Estar-AH Base) film in the form of light pulses photographed from the data light platen. The sequence timer on each meter operates on a one hour cycle. A four lobed cam was attached to the one hour shaft; the peaks of the lobe actuate a micro-switch which commands the electronics to flash the strobe lights. This results in a sampling interval of 15 minutes. When a pulse is received from the micro-switch the strobe lights in the compass and vane assemblies are actuated, and along with the data from the rotor and inclinometer, are carried by light pipes to the data light platen.

American Machine and Foundary (AMF) Model 322 Acoustical Underwater Transponder/Release devices with a shipboard Range/Bearing Acoustic Relocator (AMF Model 301) were used to locate each array and release the mooring clump from each array upon command. These self-contained underwater units were also used, in the transponder mode, to determine their positions (slant range and bearing), with respect to the ship, prior to and after transmitting the release command. This feature contributed to the successful recovery of the arrays. The physical characteristics of the units are given in Table 2.

Positive buoyancy for the arrays was maintained by use of Danko-Arlington Aluminum alloy subsurface buoys. Each buoy is 109.2 cm (43 inches) in diameter, has a positive buoyancy of 453.6 Kg (1000 pounds) and a maximum operating depth of 914.4 m (3000 ft).

The arrays were constructed using various lengths of 6.35 m (1/4 inch) 3 X 19 construction, galvanized, improved plow steel wire rope; 9.4 mm (3/8 inch) galvanized, proof-coil weld link chain; 14.3 mm (9/16 inch) 2 in 1 construction, braided white nylon line; 1363 Kg (1.5 ton) Miller Ball Bearings Swivels, and NEWCO synthetic thimbles. Each array was moored by two 55-gallon barrels filled with heavy density concrete and interlocked by two lengths of 7.6 cm (3 inch) iron pipe. Each clump had an approximate in air weight of 1020 Kg (2200 pounds). A 40.6 cm (16 inch) diameter Corning glass sphere (with a polyethylene hard hat) was connected to the top of the subsurface buoy by 9.1 m (30 ft) of 12.7 mm (1/2 inch), green braided polypropylene pennant. This pennant was used to facilitate recovery operations. Figures 2 and 3 are schematic representations of Arrays 3 and 4 respectively.

IMPLANT AND RECOVERY PROCEDURES

The arrays were implanted using the "anchor-last" or "free-fall" technique. The various lengths of wire, rope and nylon line for each array were stored on wooden reels, in a prescribed sequence, so that the first required length was the last length stored on the reel. The reel containing wire rope was placed on a reel stand and lashed into place. Launching operations commenced by deploying the glass sphere with pennant, lowering the subsurface buoy and first current meter into the water and

TABLE 1

A-101-1 CURRENT METER PHYSICAL CHARACTERISTICS

Length (including bails)	1.85 m (72 inches)
Maximum Diameter	21.59 cm (8.5 inches)
Material	Aluminum (7075-T6)
Weight in Air	50 kg (110 pounds)
Weight in Water	16.4 kg (36.5 pounds)
Operating Depth (MAX)	5394 m (17,700 feet)

TABLE 2

AMF MODEL 322 TRANSPONDER/RELEASE DEVICE PHYSICAL CHARACTERISTICS

Length	1.29 m (51 inches)
Diameter	29.21 cm (11.5 inches)
Material	Aluminum (7075-T6) Stainless Steel
Weight in Air	60 kg (130 pounds)
Weight in Water	31.8 kg (70 pounds)
Operating Depth (MAX)	6096 m (20,000 feet)

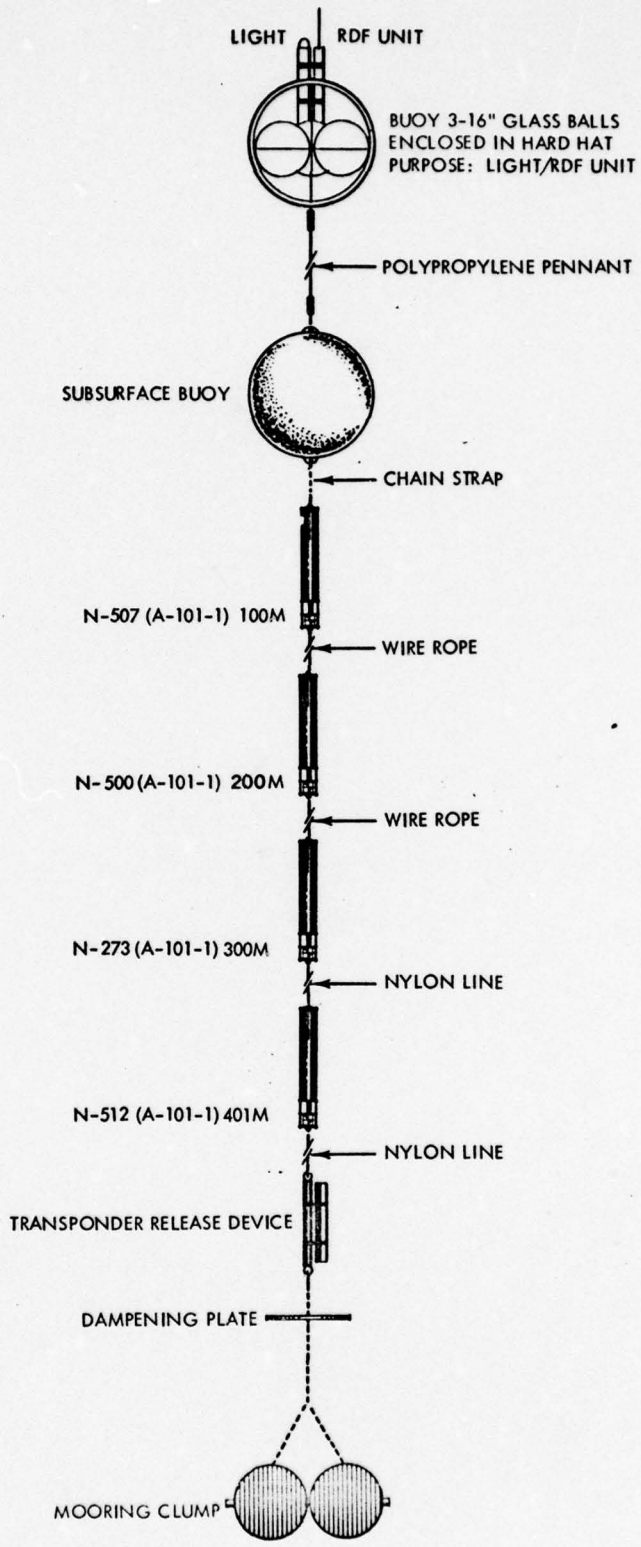


Figure 2. Schematic representation of Array 3

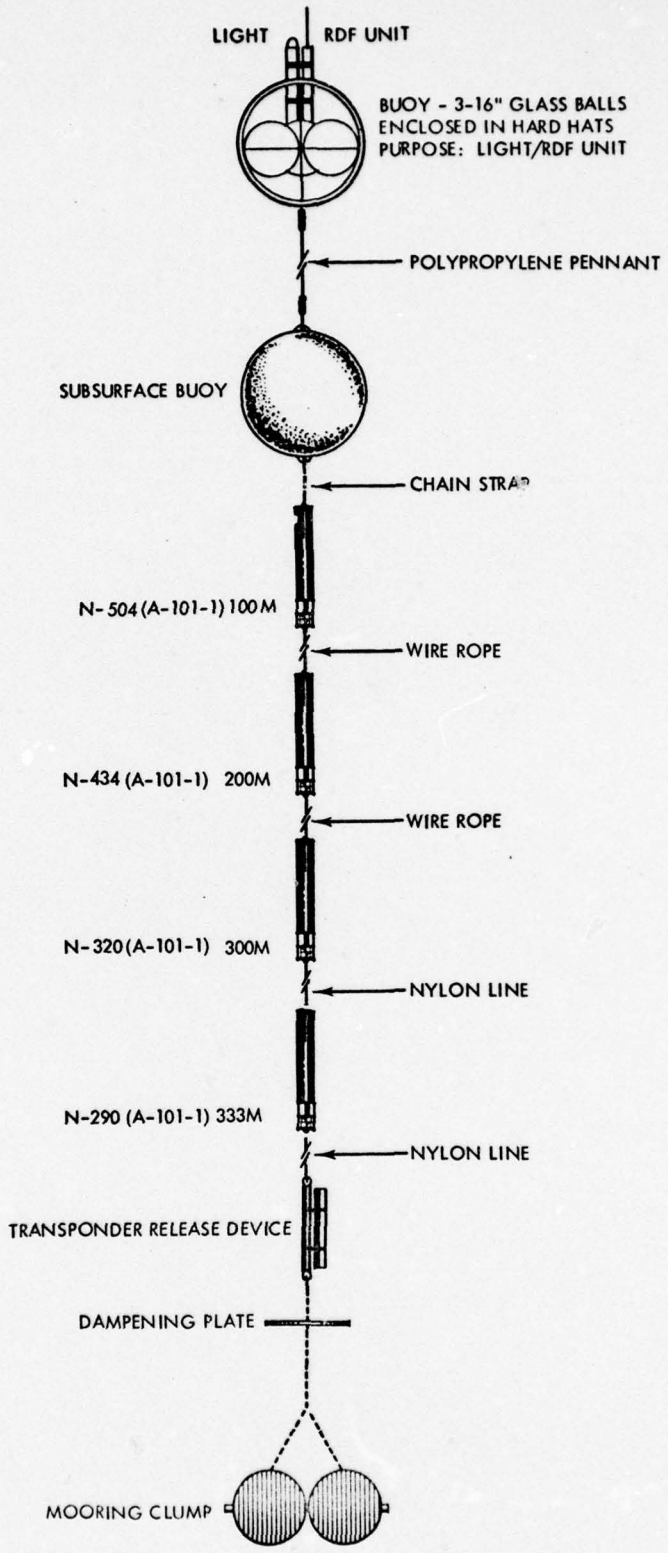


Figure 3. Schematic representation of Array 4

then activating a quick-release hook which was secured to a lowering line through the ship's starboard u-frame. In order to expedite deployment of the mooring line, the ship was occasionally maneuvered away from the floating subsurface buoy. Mooring line tensions were kept low and manageable by securing inflated PVC floats to the line. The attached anchor was lifted outboard and released by a quick-release hook after deploying the current meters, acoustic transponder/ release device, and required lengths of mooring line. Positions for the ship and each array were obtained by satellite navigation.

Recovery was accomplished by using the underwater transponder/ release device with the AMF shipboard command system.

DATA PROCESSING

After recovery, the current meter cameras were unloaded and data films were developed at the Naval Research Laboratory (NRL). The developed films were then processed at NAVOCEANO by an in-house developed Optical Digital Analog Computer (OPDAC). OPDAC transfers digital data from the film onto IBM magnetic tape and also generates a multichannel strip chart analog trace of this data. A summary of current meter data is shown in Tables 3 and 4. The number of frames listed for each current meter (last column in each of these tables), is based on the number of data frames read by OPDAC.

Based on a record length of 923 hours and 18 minutes (meter start to meter stop time) and a sampling interval of 15 minutes, the maximum number of frames for any meter in Array 3 should be 3693. If, however, the clock used to start the sampling is off (plus or minus a few seconds) then the actual number of frames will be higher or lower (by a small number) then the calculated number of frames. This is evident with the instruments at 100, 200, and 401 meters. The film-advance mechanism of meter N-273 stopped functioning after the meter had recorded only 2904 frames of data. The resulting record was thus short by some 789 frames (197 hours) of data.

The maximum number of data frames possible for the meters of Array 4 is 3673 (for a record length of 918 hours and 17 minutes and a 15 minute sampling rate). Meter N-290 had 3586 frames, due again to a faulty film-advance mechanism. Approximately 87 frames of data (22 hours) were not recorded. The cam in meter N-434 was not aligned properly causing the data to be recorded off-track. The film from this meter cannot be OPDACed and will therefore have to be hand-read. The rotor on meter N-320 stuck causing the instrument to record mostly zero speeds and therefore rendering this record unusable.

RESULTS

Figures 4 through 9 are computer printouts of the bivariate distribution of speed (3 cm/sec intervals) and direction (15° intervals) for each meter of the two arrays. Each printout is based on half-hour averages consisting of 2 data frames.

Data for printouts of Array 3 are for a 38-day period from 0000Z on 28 July through 0000Z on 4 September 1974, with the exception of the printout for meter N-273 (short record). Speeds were low to moderate and decreased only slightly with depth from a

maximum of 39 cm/sec at 100 meters to a maximum of 33 cm/sec at 401 meters. Currents throughout the water column exhibited an east by northeast flow pattern.

Data for printouts of Array 4 are for a 37 - day period from 0000Z on 29 July through 1200Z on 4 September 1974. Speeds were low to moderate and decreased with depth from a maximum of 39 cm/sec at 100 meters to a maximum of 27 cm/sec at 333 meters. It should be noted that this conclusion is based on observations from only two instruments at 100 and 333 meters because the instruments at 200 and 300 meters failed to operate properly. Currents at both levels showed two distinct trends of flow. At the 100 meter level, the flow pattern was south - southeast and north - northwest. On the 333 meter level the pattern shifted somewhat to an east - southeast and west - northwest flow.

Appendix A contains a cumulative speed distribution graph for each array. Appendix B contains graphs of current vectors as a function of time for each meter of each array. Each plotted line represents a vector which was averaged over a 60 minute period. The distance between the long tick marks covers a period of 24 hours with each of these time periods being divided by a shorter tick mark representing 12 hours. It should be noted that north is to the readers right. Array 3 shows a current flow pattern to the east - northeast that is prevalent at all levels with little tidal influence. Array 4 shows a current flow pattern that appears to be influenced by tidal conditions as is evident by a change in flow direction every 5 to 6 hours at both recorded levels.

CURRENT METER S/N	METER DEPTH (meters)	METER START TIME	ARRAY MOORED	RELEASE DEVICE FIRED	METER STOP TIME	SAMPLING INTERVAL (minutes)	RECORD LENGTH	NO. OF FRAMES ON FILM
N-507	100	7-27-74 2145Z	7-28-74 0200Z	9-4-74 0330Z	9-4-74 0903Z	15	923 hrs 18 min	3710
N-500	200	7-27-74 2145Z	7-28-74 0200Z	9-4-74 0330Z	9-4-74 0903Z	15	923 hrs 18 min	3709
N-273	300	7-27-74 2145Z	7-28-74 0200Z	9-4-74 0330Z	9-4-74 0903Z	15	923 hrs 18 min	2904
N-512	401	7-27-74 2145Z	7-28-74 0200Z	9-4-74 0330Z	9-4-74 0903Z	15	923 hrs 18 min	3712

Table 3. Summary of current meter data for Array 3

CURRENT METER S/N	METER DEPTH (meters)	METER START TIME	ARRAY MOORED	RELEASE DEVICE FIRED	METER STOP TIME	SAMPLING INTERVAL (minutes)	RECORD LENGTH	NO. OF FRAMES ON FILM
N-504	100	7-28-74 1250Z	7-28-74 1400Z	9-4-74 1545Z	9-4-74 1827Z	15	918 hrs 17 min	3626
N-434	200	7-28-74 1250Z	7-28-74 1400Z	9-4-74 1545Z	9-4-74 1827Z	15	918 hrs 17 min	3626
N-320	300	7-28-74 1250Z	7-28-74 1400Z	9-4-74 1545Z	9-4-74 1827Z	15	918 hrs 17 min	3627
N-290	333	7-28-74 1250Z	7-28-74 1400Z	9-4-74 1545Z	9-4-74 1827Z	15	918 hrs 17 min	3586

Table 4. Summary of current meter data for Array 4

WILKES NORW SEA 72 59.9N/25 55.3E ARRAY 3 CM N-507 DEPTH = 100M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 413M START TIME = 2145 27JUL74 R/L = 923 HRS

DIRECTION														SUM	PER.CT.
0- 15	16	12	13	11	9	3	1	1						66	3.6
15- 30	16	13	17	11	5		2	1	1	1				67	3.7
30- 45	15	13	9	8	10	4	7	2	1	2				71	3.9
45- 60	12	27	15	22	22	25	14	14	7	7	2	2		169	9.2
60- 75	10	27	56	26	35	30	26	30	16	13	7	10		286	15.6
75- 90	8	23	35	48	35	49	60	63	44	21	16	6	2	410	22.4
90-105	5	8	17	33	28	30	22	23	28	11	11	4	2	222	12.1
105-120	10	4	8	8	8	8	4	4	2					56	3.1
120-135	4	3	8	6	4	1								26	1.4
135-150	2	7	11	6	1									27	1.5
150-165	2	4	3	1										10	0.5
165-180	7	4	1	1										13	0.7
180-195	6	2												8	0.4
195-210	2	3	1		1									7	0.4
210-225	5	2	4	2	2									15	0.8
225-240	6			4										10	0.5
240-255	1	4	3		1	2								11	0.6
255-270	3	1	2	2	2	4	3							17	0.9
270-285	8	9	4	5	2		2							30	1.6
285-300	8	14	10	7	5	6	2							52	2.8
300-315	11	14	10	10	10	3	1							59	3.2
315-330	11	15	12	6	5	1								51	2.8
330-345	18	9	4	8	9	6		1						55	3.0
345-360	13	12	27	14	5	7	3	1		1				83	4.5

SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	199	231	270	239	199	179	147	140	99	56	36	22	4	0	0	0	0	0	0	0	0	1821
PER.CT.	10.9	12.6	14.7	13.0	10.9	9.8	8.0	7.6	5.4	3.1	2.0	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NUMBER OF ZERO SPEED AVERAGES = 13 PERCENTAGE ZERO SPEED AVERAGES = 0.7 FIG 4
TOTAL NUMBER OF OBS. = 1834

Figure 4. Bivariate distribution - Array 3, C/M N - 507

WILKES NORW SEA 72 59.9N/25 55.3E ARRAY 3 CM N-500 DEPTH = 200M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 413M START TIME = 2145 27JUL74 R/L = 923 HRS

DIRECTION														SUM	PER.CT.
0- 15	15	23	19	22	5									84	4.6
15- 30	17	29	29	18	9	7	4	3						116	6.3
30- 45	10	38	47	21	22	25	12	10	1					186	10.1
45- 60	8	23	35	49	23	16	25	16	10	10	3	3	1	222	12.1
60- 75	15	25	25	23	43	43	34	26	19	16	7	3		279	15.2
75- 90	16	15	32	31	40	54	26	24	13	4				255	13.9
90-105	4	5	21	27	21	18	21	5	3					125	6.8
105-120	7	9	15	7	6	10	6	2						62	3.4
120-135	7	9	3	4	4	3	1							31	1.7
135-150	8	8	4	2										22	1.2
150-165	2	3												5	0.3
165-180	5		2											7	0.4
180-195	3	3	1											7	0.4
195-210	3	3	1											7	0.4
210-225	9	2	2											13	0.7
225-240	8	5	1											14	0.8
240-255	8	3	5	1										17	0.9
255-270	6	3	7	5	2									23	1.3
270-285	10	8	18	11	6	3	3	1						60	3.3
285-300	13	6	10	5	2	2								38	2.1
300-315	17	15	9	4	6	2								53	2.9
315-330	15	18	13	3	6									55	3.0
330-345	12	25	8	15	3	3								66	3.6
345-360	14	22	16	10	3			1						66	3.6

SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	232	300	323	258	201	186	132	88	46	30	10	6	1	0	0	0	0	0	0	0	0	1813
PER.CT.	12.7	16.4	17.6	14.1	11.0	10.1	7.2	4.8	2.5	1.6	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NUMBER OF ZERO SPEED AVERAGES = 20 PERCENTAGE ZERO SPEED AVERAGES = 1.1 FIG 5
TOTAL NUMBER OF OBS. = 1833

Figure 5. Bivariate distribution - Array 3, C/M N - 500

WILKES NORW SEA 72 59.9N/25 55.3E ARRAY 3 CM N-273 DEPTH = 300M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 413M START TIME = 2145 27JUL74 R/L = 923 HRS

DIRECTION													SUM	PER.CT.
0- 15	10	14	7	4									35	2.4
15- 30	12	19	21	18	10								80	5.6
30- 45	14	25	21	20	6	9	3	1					99	6.9
45- 60	8	27	43	35	23	17	11	12	2	3			181	12.6
60- 75	12	19	37	51	74	63	28	10	18	2	3	1	318	22.2
75- 90	12	21	36	50	44	24	18	11	8	8	1		233	16.3
90-105	7	15	20	11	15	7	9		2				86	6.0
105-120	9	8	5	2	1								25	1.7
120-135	2	2											4	0.3
135-150	1	1											2	0.1
150-165	4	2											6	0.4
165-180	2												2	0.1
180-195	5												5	0.3
195-210	4	1											5	0.3
210-225	6	1											7	0.5
225-240	5	4											9	0.6
240-255	12	14	1										27	1.9
255-270	6	10	10										26	1.8
270-285	9	15	17	12	2								56	3.9
285-300	16	9	18	10	6								59	4.1
300-315	11	11	12	9	1								44	3.1
315-330	11	11	8	9									39	2.7
330-345	7	12	8										27	1.9
345-360	10	10	8	1									29	2.0

SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	195	252	272	232	182	120	69	34	30	13	4	1	0	0	0	0	0	0	0	0		1404
PER.CT.	13.6	17.5	19.0	16.2	12.7	8.4	4.8	2.4	2.1	0.9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		

NUMBER OF ZERO SPEED AVERAGES = 27 PERCENTAGE ZERO SPEED AVERAGES = 1.9
TOTAL NUMBER OF OBS. = 1431

FIG 6

Figure 6. Bivariate distribution - Array 3, C/M N - 273

WILKES NORW SEA 72 59.9N/25 55.3E ARRAY 3 CM N-512 DEPTH = 401M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 413M START TIME = 2145 27JUL74 R/L = 923 HRS

DIRECTION												SUM	PER.CT.
0- 15	10	23	19	14	6	3	1	1				77	4.2
15- 30	7	17	13	25	17	7	1					87	4.7
30- 45	12	11	18	34	38	25	4	9	1			152	8.3
45- 60	18	19	27	47	55	36	20	9	1		1	233	12.7
60- 75	16	34	41	49	51	46	33	16	7	4	2	299	16.3
75- 90	11	16	28	37	29	27	20	10	3	2		183	10.0
90-105	9	16	17	31	24	16	8	3				124	6.8
105-120	9	22	17	9	10	3						70	3.8
120-135	7	16	11	5	3							42	2.3
135-150	4	9	6	5	4							28	1.5
150-165	5	16	14	5								40	2.2
165-180	10	3	7									20	1.1
180-195	4	10	3									17	0.9
195-210	4	2	5									11	0.6
210-225	7	4	5	1								17	0.9
225-240	5	5	7	4								21	1.1
240-255	7	13	3	3	1							27	1.5
255-270	6	8	5	1	3							23	1.3
270-285	9	5	9	1	2							26	1.4
285-300	10	14	12	11	3	1						51	2.8
300-315	10	22	12	9	9	1						63	3.4
315-330	11	10	2	4	3	1						31	1.7
330-345	19	27	16	7	8	1						78	4.3
345-360	9	24	16	19	9	3	1					81	4.4

SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	219	346	313	321	275	170	88	48	12	6	3	0	0	0	0	0	0	0	0	0	0	1801
PER.CT.	11.9	18.9	17.1	17.5	15.0	9.3	4.8	2.6	0.7	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NUMBER OF ZERO SPEED AVERAGES = 34 PERCENTAGE ZERO SPEED AVERAGES = 1.9 FIG 7
TOTAL NUMBER OF OBS. = 1835

Figure 7. Bivariate distribution - Array 3, C/M N - 512

WILKES NORW SEA 71 46.2N/26 46.1E ARRAY 4 CM N-504 DEPTH = 100M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 345M START TIME = 1250 28JUL74 R/L = 918 HRS

DIRECTION														SUM	PER.CT.
0- 15	7	6	9	10	5	1								38	2.1
15- 30	4	4	8	4										20	1.1
30- 45	10	7	5	1										23	1.3
45- 60	5	5	6		1	1	1							19	1.1
60- 75	7	7	4	1	6	3	3	1						32	1.8
75- 90	8	9	4	4	5	7	7							44	2.5
90-105	4	10	14	11	4									43	2.4
105-120	4	8	9	13	5	3								42	2.4
120-135	6	8	13	16	17	16	5	3						84	4.7
135-150	9	13	10	17	16	17	5	1	1	1	1			91	5.1
150-165	2	13	9	16	18	15	14	7	5		1	1		101	5.7
165-180	11	11	23	26	36	36	43	41	32	11	10	2	1	283	15.9
180-195	3	19	23	27	20	13	9	7	7	1	5	1	1	136	7.6
195-210	6	10	14	4	3	2		3	2	1	2			47	2.6
210-225	4	15	7	3				2		1	1			33	1.9
225-240	7	21	1	1			1		1		1			33	1.9
240-255	13	13	7											33	1.9
255-270	12	16	3					1	1					33	1.9
270-285	3	17	5	2				1	1					29	1.6
285-300	16	17	11	4			2	2	1					53	3.0
300-315	9	10	11	11	7	3	3	5	3					62	3.5
315-330	10	29	26	17	18	7	5	6	6	4				128	7.2
330-345	9	27	44	63	52	23	12	14	14	12	1			271	15.2
345-360	8	13	21	19	20	12	2	1						96	5.4

SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	177	308	287	270	233	159	112	95	74	31	22	4	2	0	0	0	0	0	0	0	0	1774
PER.CT.	9.9	17.3	16.1	15.2	13.1	8.9	6.3	5.3	4.2	1.7	1.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NUMBER OF ZERO SPEED AVERAGES = 6 PERCENTAGE ZERO SPEED AVERAGES = 0.3 FIG 8
TOTAL NUMBER OF OBS. = 1780

Figure 8. Bivariate distribution - Array 4, C/M N - 504

WILKES NORW SEA 71 46.2N/26 46.1E ARRAY 4 CM N-290 DEPTH = 333M S/R = 15MIN
HALF-HOUR AVERAGES WATER DEPTH = 345M START TIME = 1250 28JUL74 R/L = 918 HRS

DIRECTION										SUM	PER.CT.
0- 15	1	8	4	5	6					24	1.4
15- 30	1	4	4	6	1					16	0.9
30- 45	1	2	6	3						12	0.7
45- 60	3	4	6	9	8	1				31	1.8
60- 75	6	7	10	9	8					40	2.3
75- 90	7	17	17	15	16	6	2			80	4.5
90-105	7	11	23	33	35	30	8			147	8.4
105-120	7	19	17	26	21	21	14	6	1	132	7.5
120-135	7	23	26	20	6	4				86	4.9
135-150	8	16	11	22	3	8	2			70	4.0
150-165	6	12	11	6	8	3	2			48	2.7
165-180	6	7	28	12	4	1		1		59	3.4
180-195	11	14	26	12	6	1		1		71	4.0
195-210	6	21	37	15	8	3	1			91	5.2
210-225	2	11	18	16	2	2				51	2.9
225-240	11	22	27	17	11	5	4	2		99	5.6
240-255	8	13	22	22	18	12	1			96	5.5
255-270	10	24	28	39	38	33	11	3		186	10.6
270-285	4	19	28	40	39	46	25	3	2	205	11.6
285-300	1	7	16	16	13	11	19	6	4	93	5.3
300-315	7	7	11	9	3	1				38	2.2
315-330	1	3	6	6	2	1				19	1.1
330-345		3	6	8	2					19	1.1
345-360	7	2	7	5	7	1				29	1.6

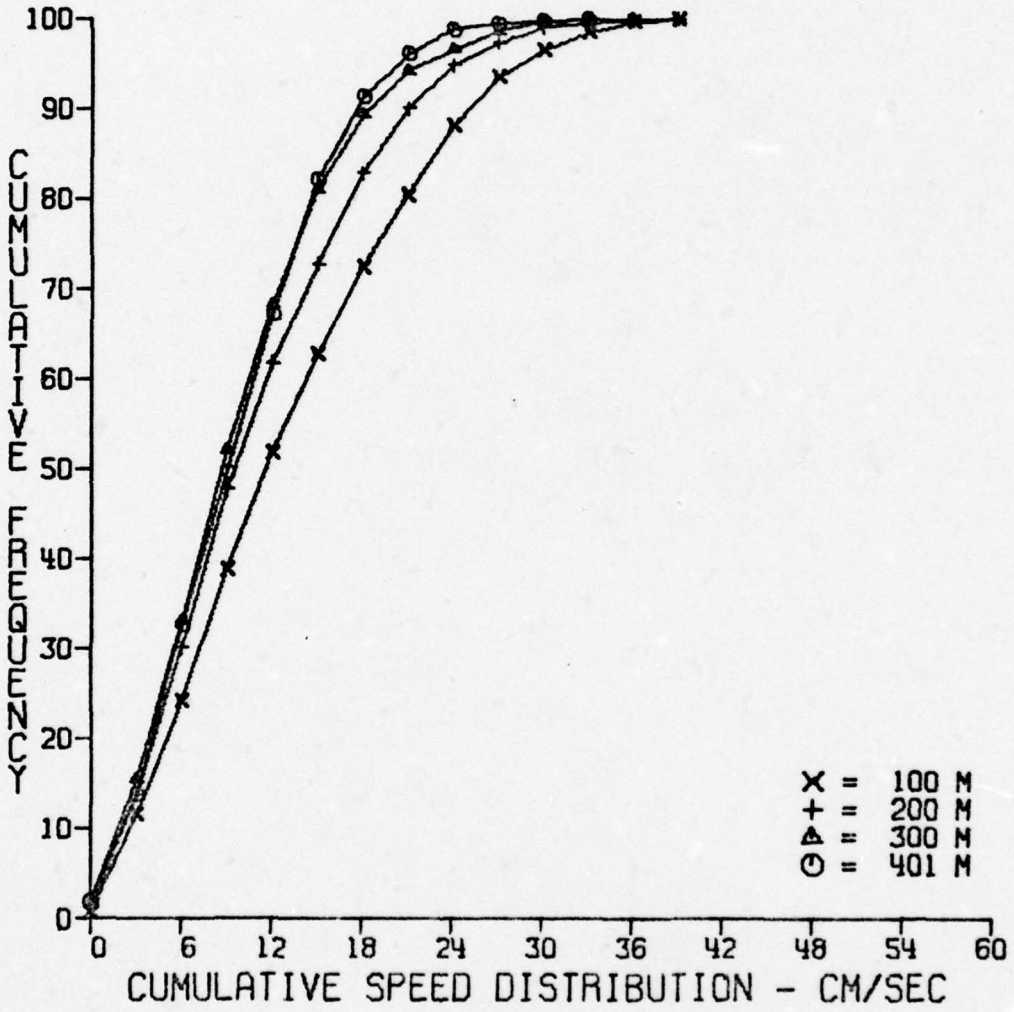
SPEED	0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	
SUM	128	275	395	371	265	190	89	22	7	0	0	0	0	0	0	0	0	0	0	0	0	1742
PER.CT.	7.3	15.6	22.4	21.1	15.1	10.8	5.1	1.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

NUMBER OF ZERO SPEED AVERAGES = 18 PERCENTAGE ZERO SPEED AVERAGES = 1.0 FIG 9
TOTAL NUMBER OF OBS. = 1760

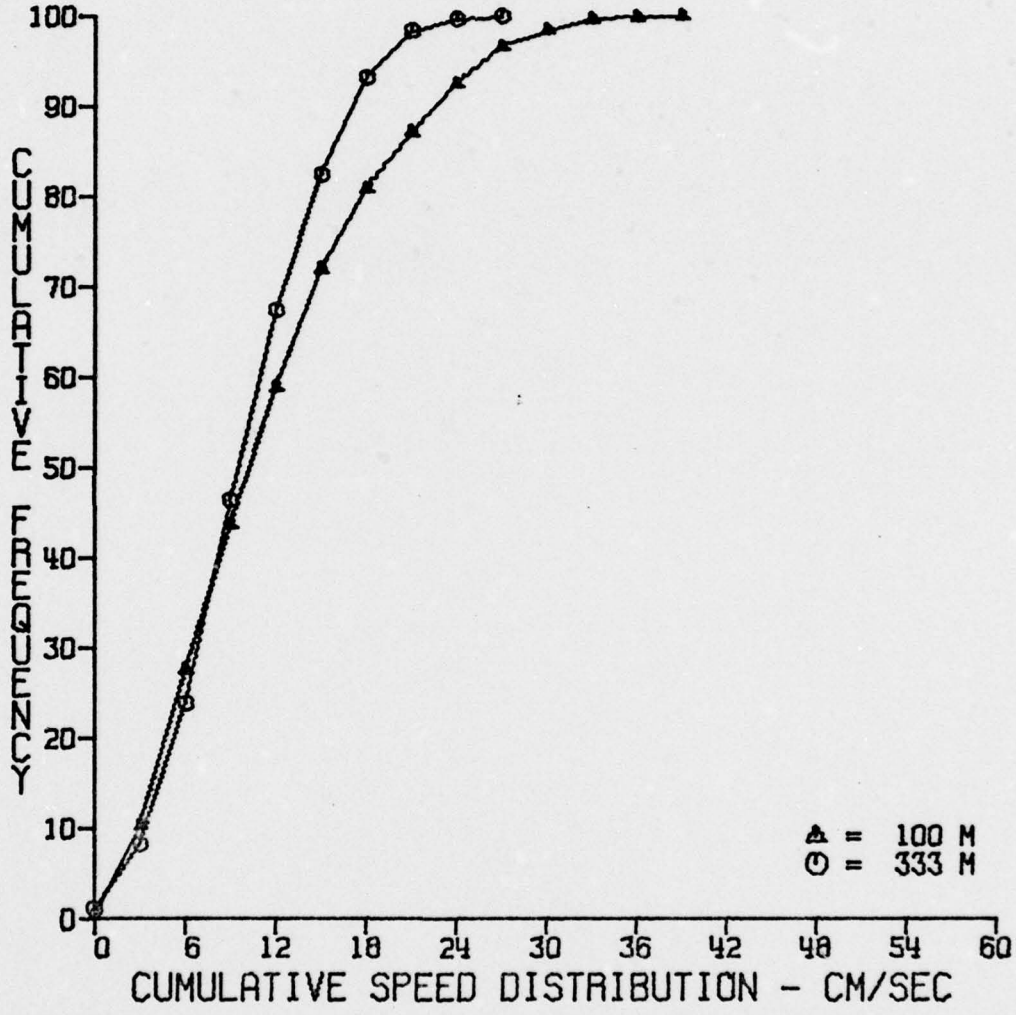
Figure 9. Bivariate distribution - Array 4, C/M N - 290

APPENDIX A

CUMULATIVE SPEED DISTRIBUTION GRAPHS



WILKES NORW SEA ARRAY*3*



WILKES NORW SEA ARRAY*4*

APPENDIX B

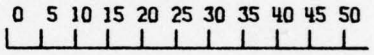
GRAPHS OF VECTOR AVERAGES

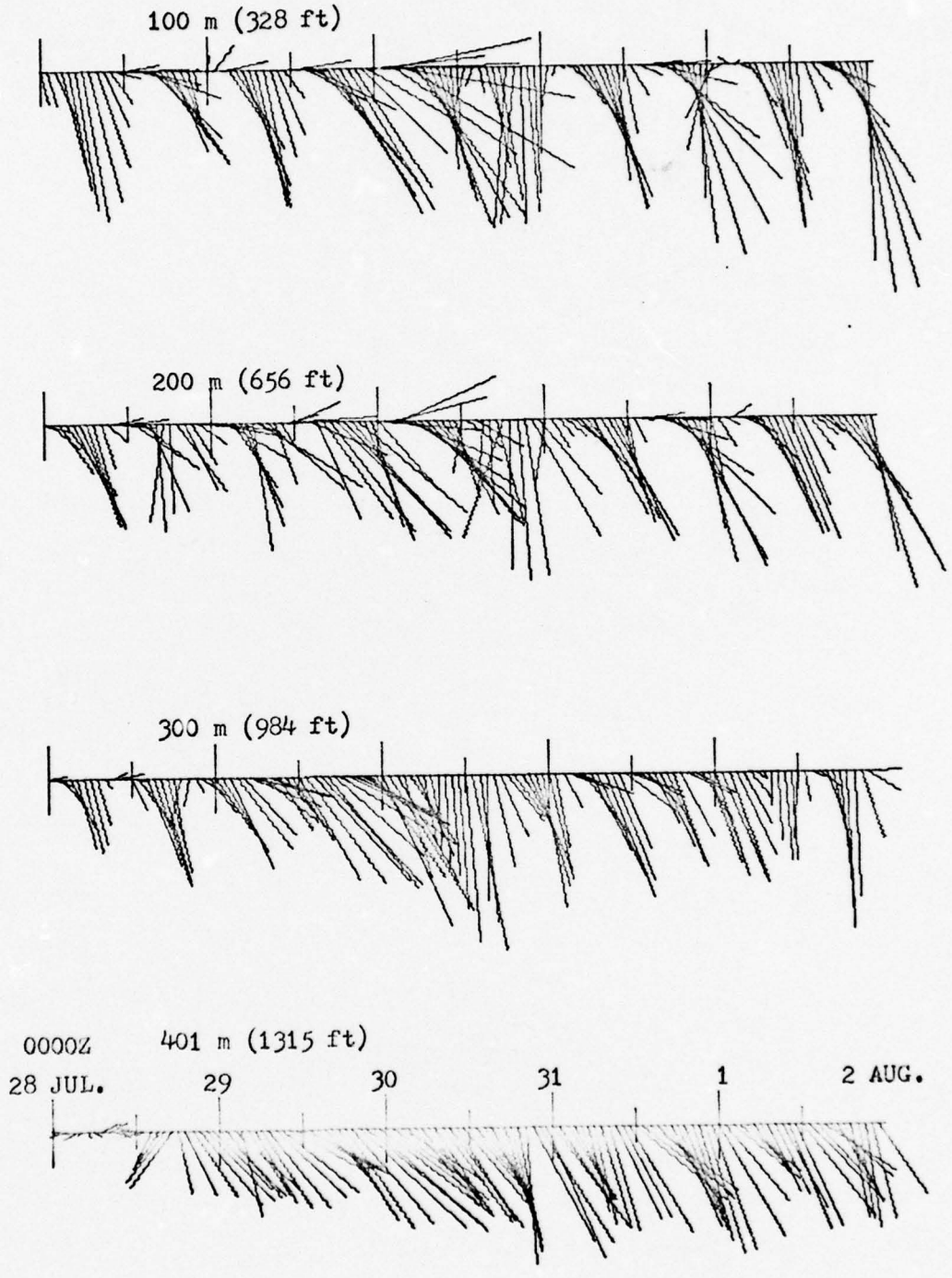
WILKES NORW SEA JULY-SEPT 1974

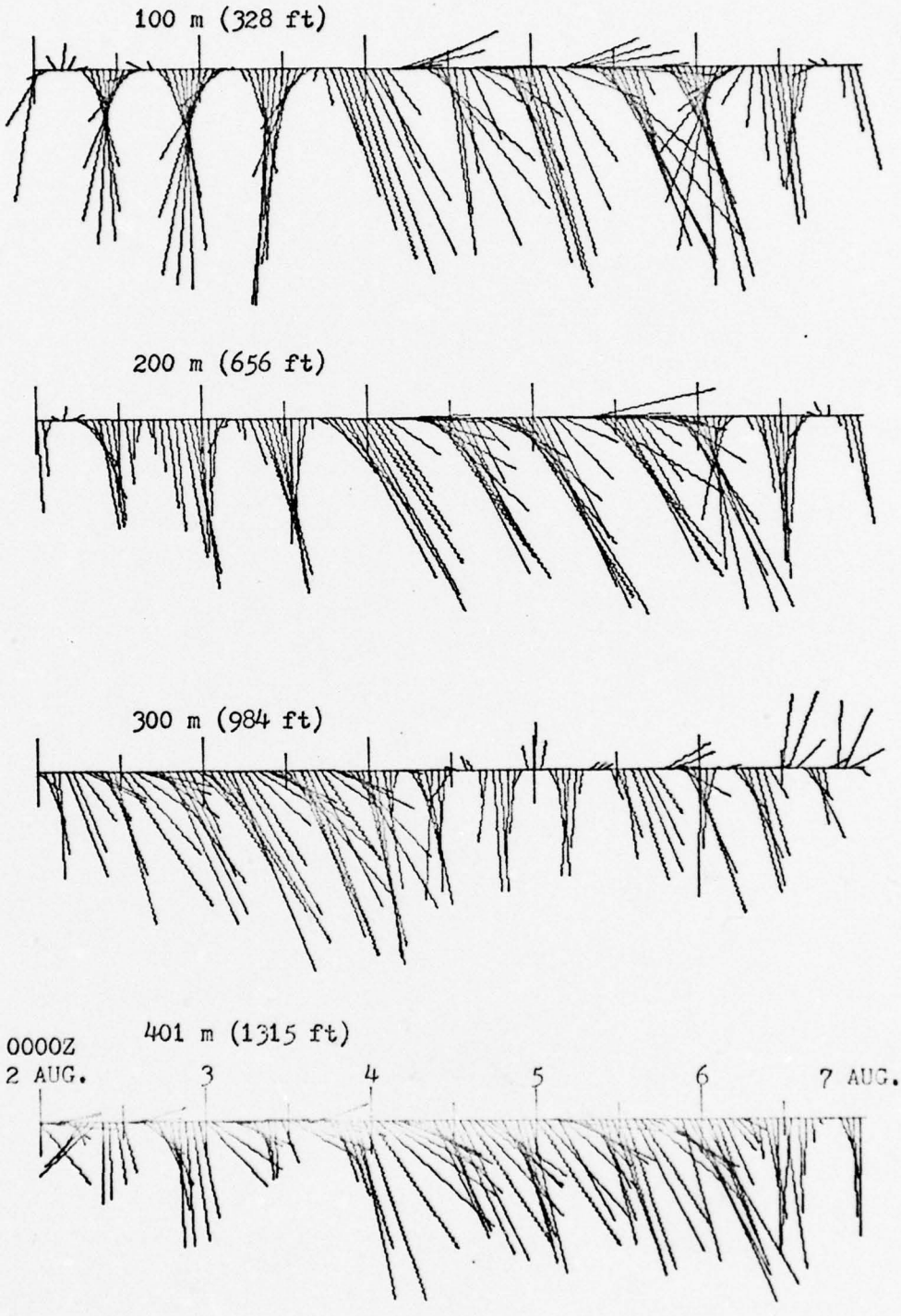
WATER DEPTH = 413 METERS

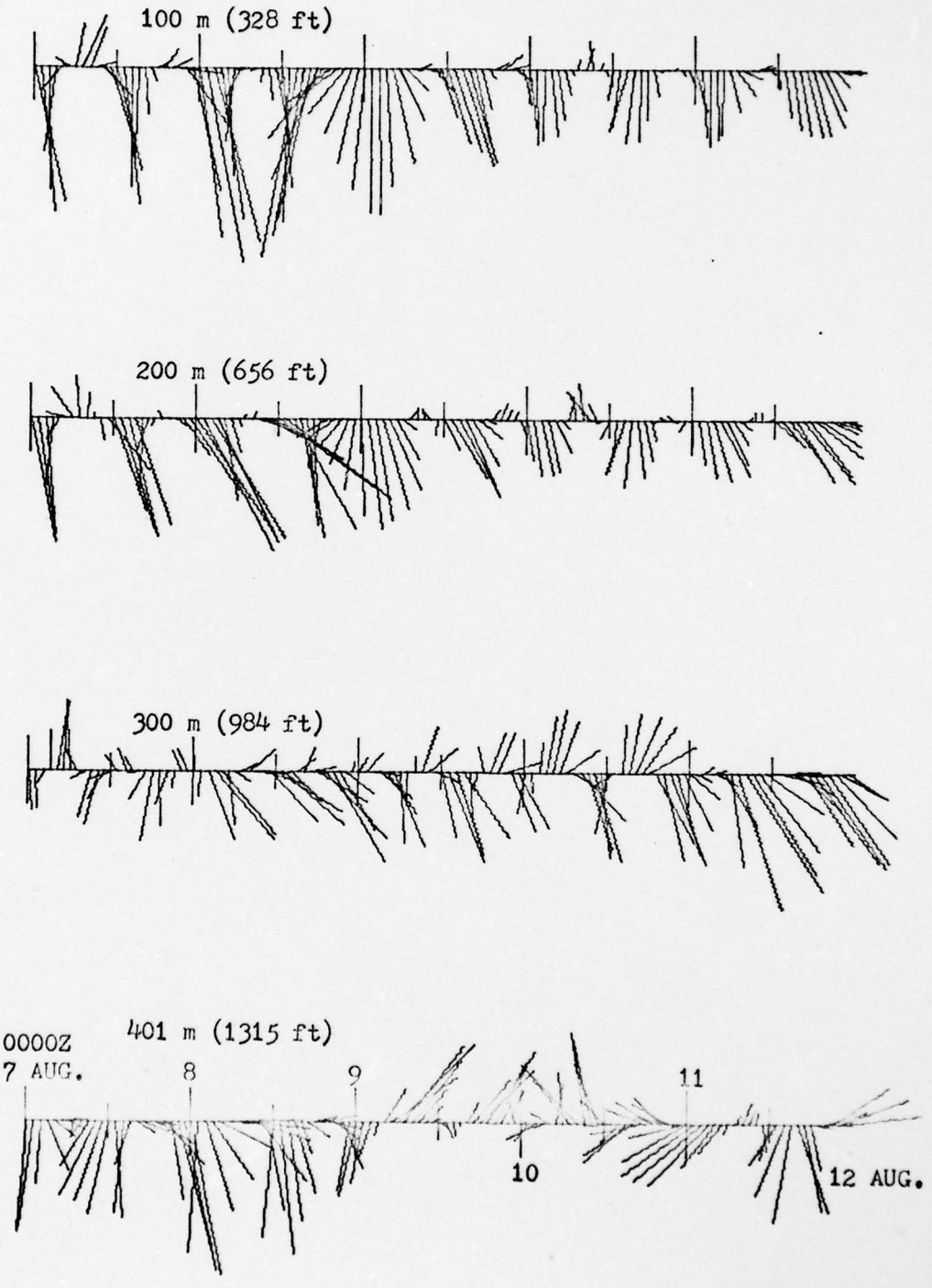
ARRAY *3* HOUR AVERAGES

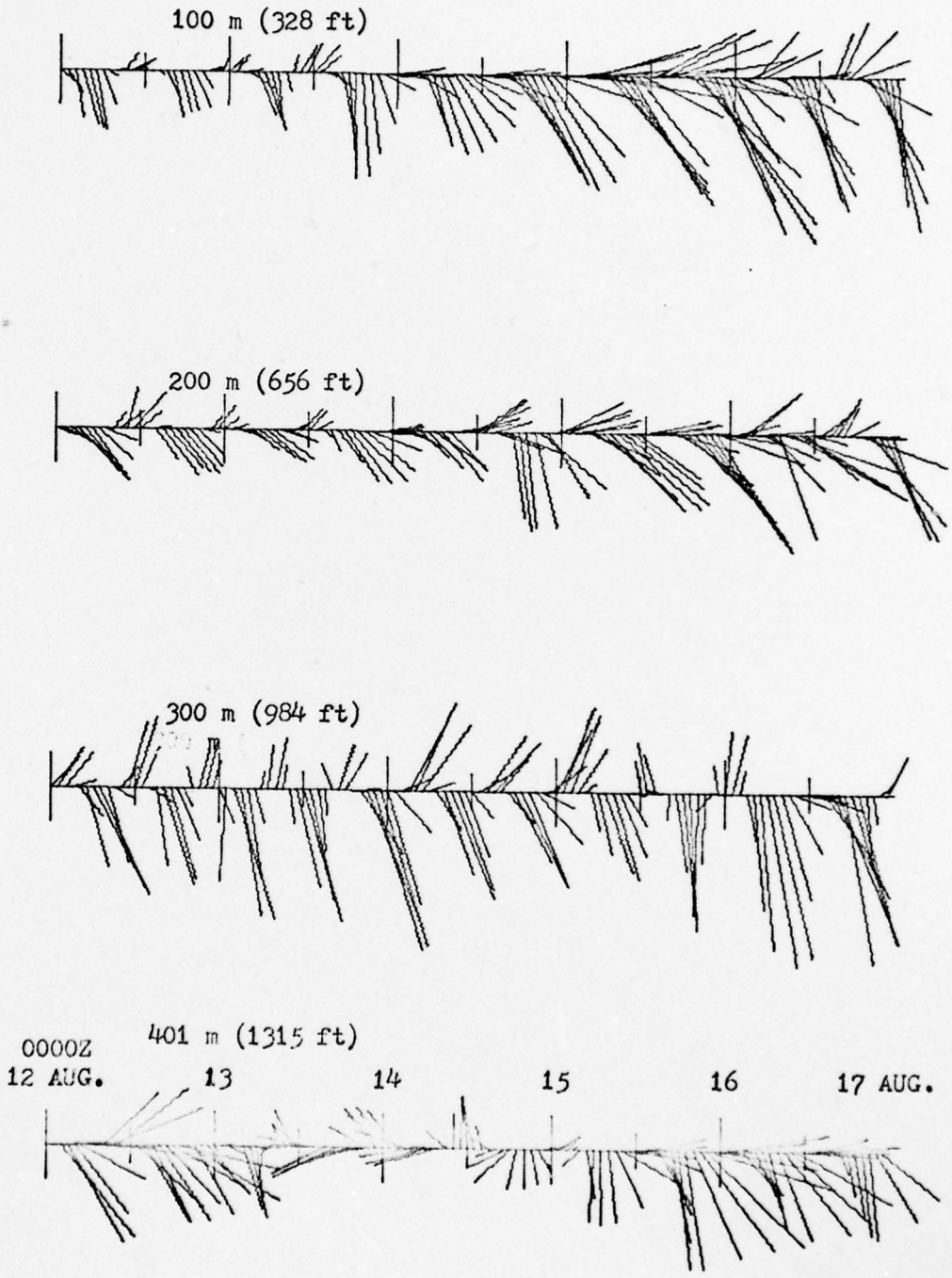
CURRENT METER	DEPTH - METERS
N-507	100
N-500	200
N-273	300
N-512	401

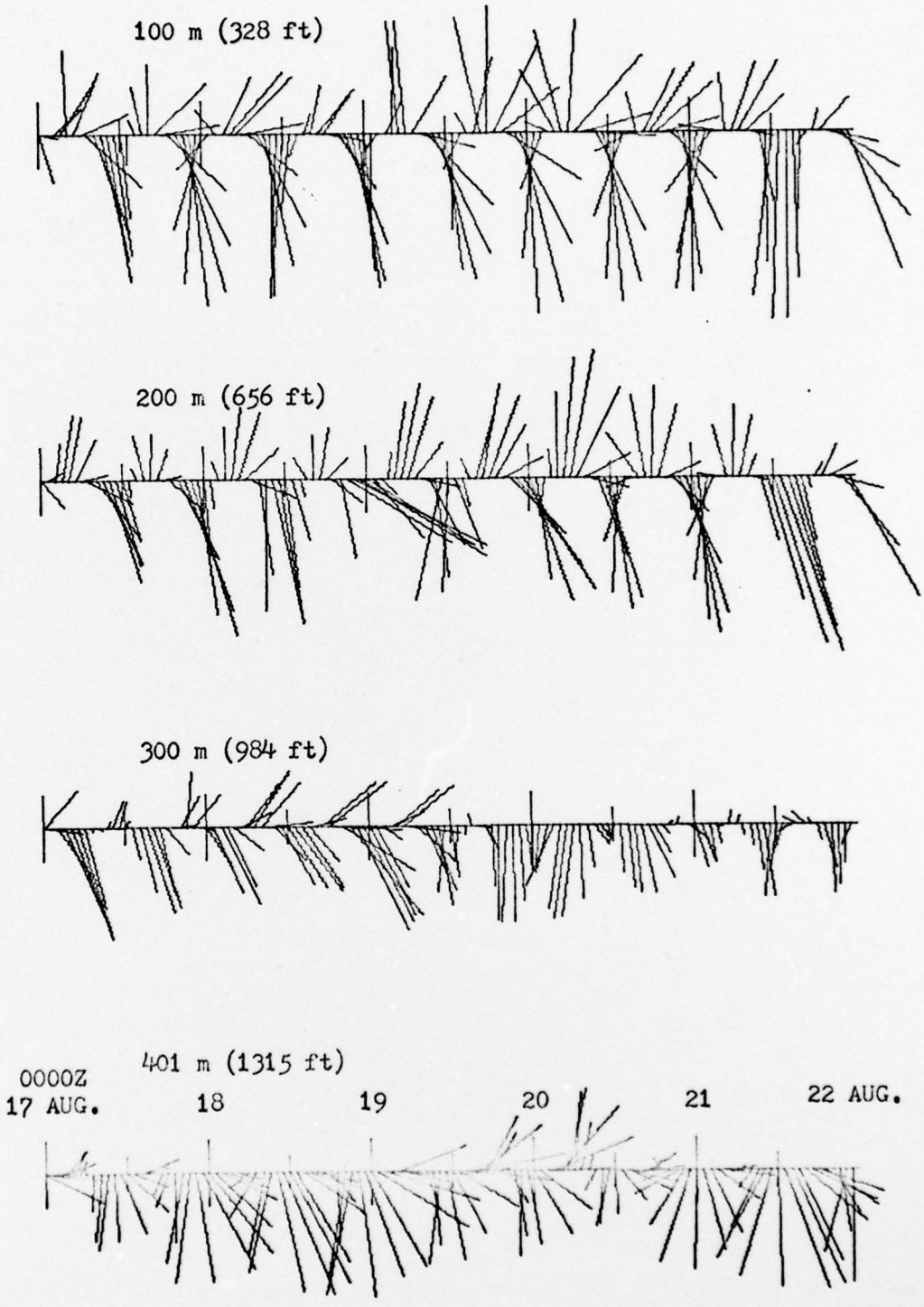
SCALE = 10 CM/SEC PER CM 

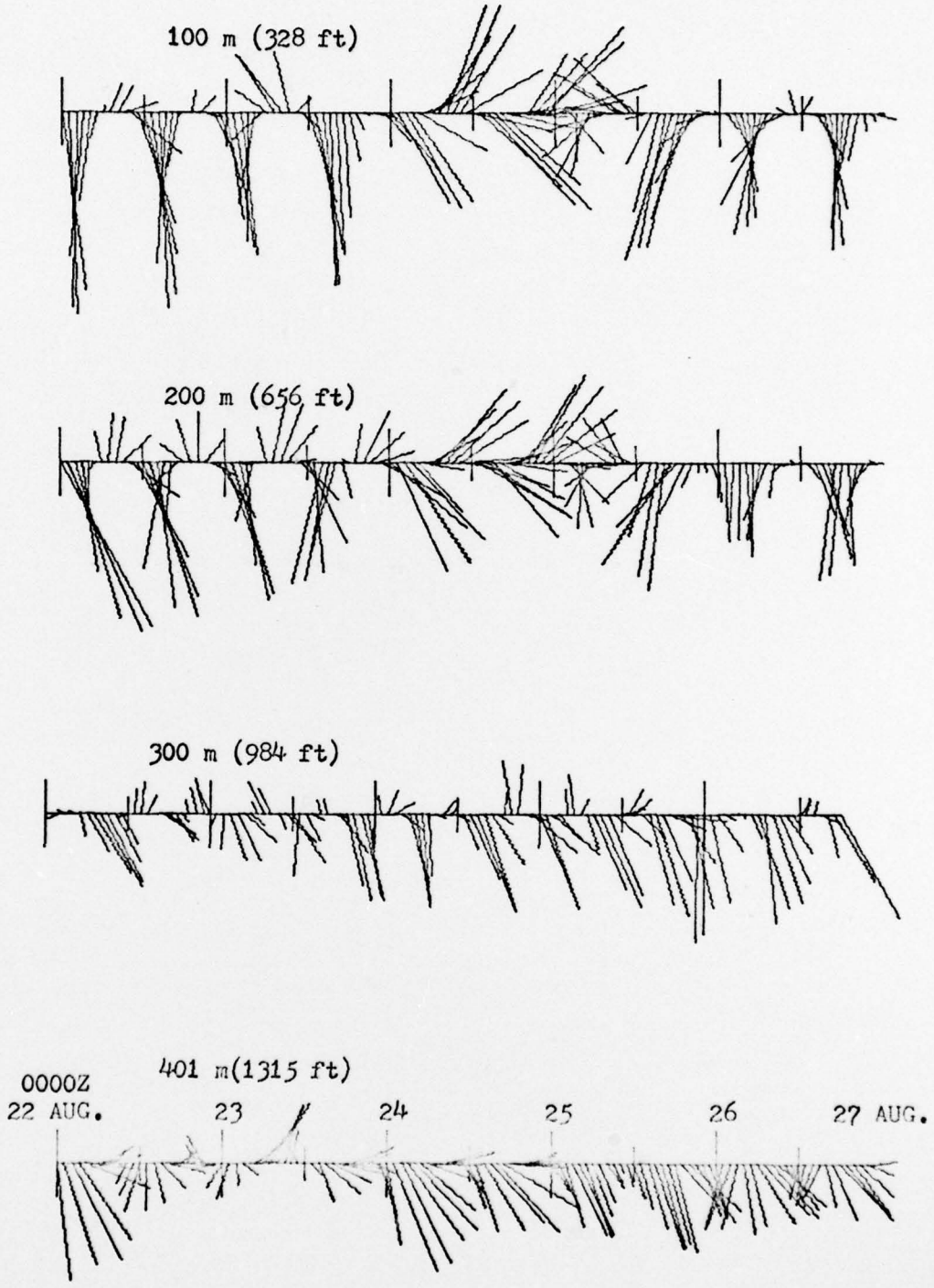

100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
0000Z
401 m (1315 ft)
28 JUL.
29
30
31
1
2 AUG.

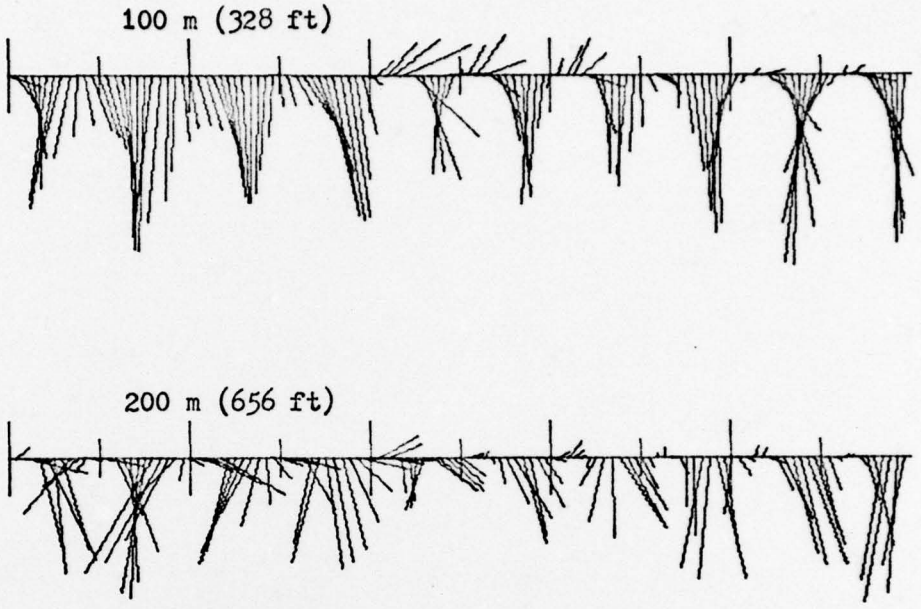

100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
401 m (1315 ft)
0000Z
2 AUG.
3
4
5
6
7 AUG.


100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
401 m (1315 ft)
0000Z
7 AUG.
8
9
10
11
12 AUG.

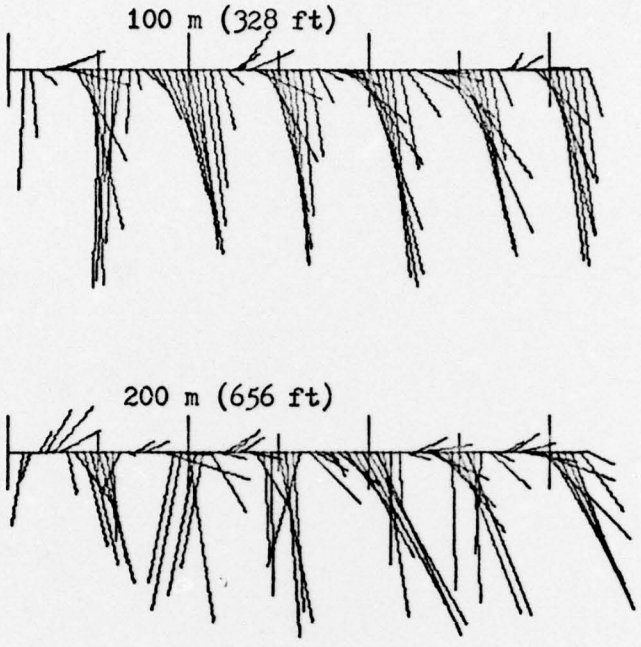

100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
401 m (1315 ft)
0000Z
12 AUG.
13
14
15
16
17 AUG.

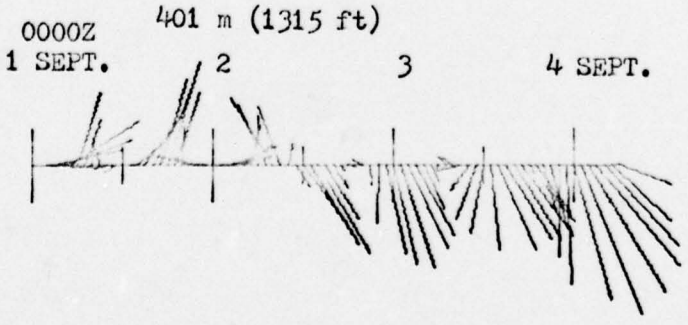

100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
401 m (1315 ft)
0000Z
17 AUG.
18
19
20
21
22 AUG.


100 m (328 ft)
200 m (656 ft)
300 m (984 ft)
401 m(1315 ft)
0000Z
22 AUG.
23
24
25
26
27 AUG.


100 m (328 ft)
200 m (656 ft)


401 m (1315 ft)
0000Z
27 AUG.
28
29
30
31
1 SEPT.


100 m (328 ft)
200 m (656 ft)

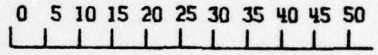

0000Z
1 SEPT.
401 m (1315 ft)
2
3
4 SEPT.

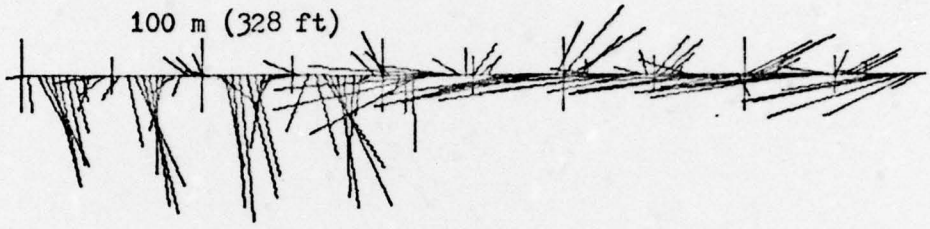
WILKES NORW SEA JULY-SEPT 1974

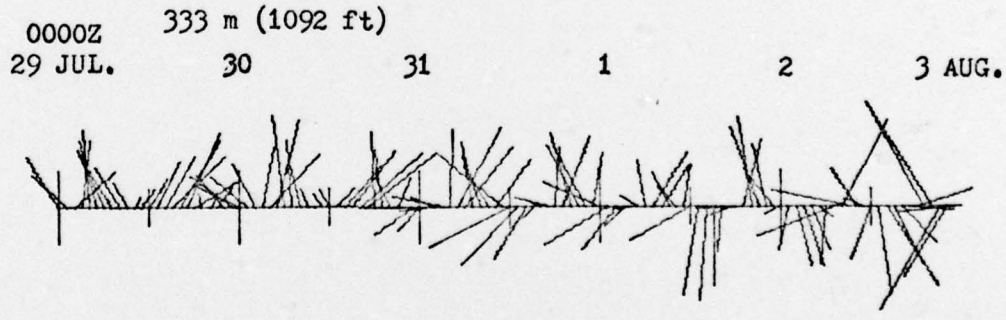
WATER DEPTH = 345 METERS

ARRAY *4* HOUR AVERAGES

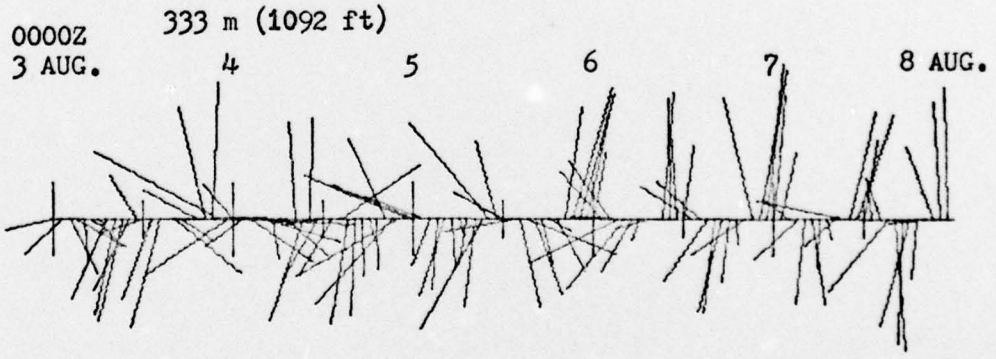
CURRENT METER	DEPTH - METERS
N-504	100
N-290	333

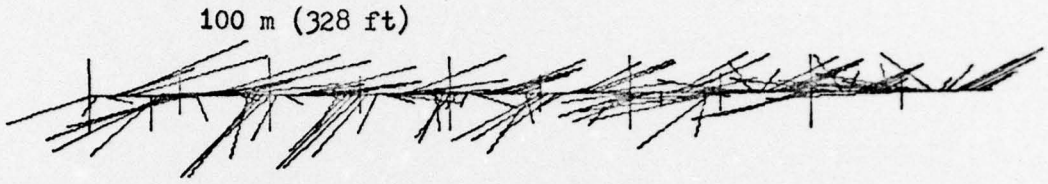
SCALE = 10 CM/SEC PER CM 

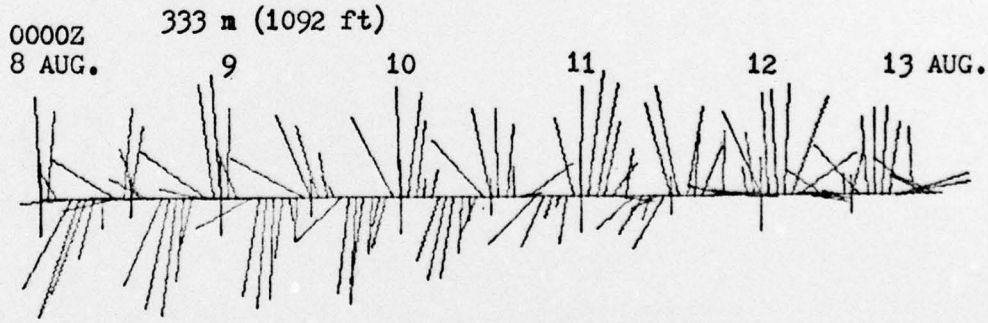

100 m (328 ft)


0000Z
29 JUL.
333 m (1092 ft)
30
31
1
2
3 AUG.

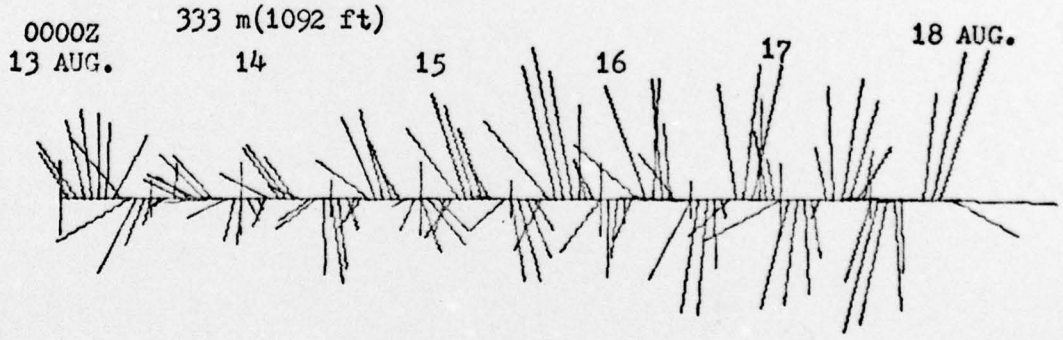

100 m (328 ft)

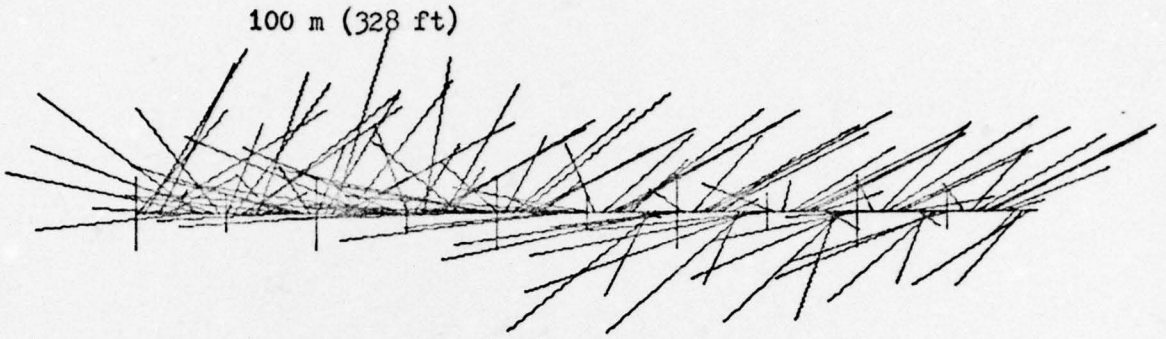

333 m (1092 ft)
0000Z
3 AUG.
4
5
6
7
8 AUG.

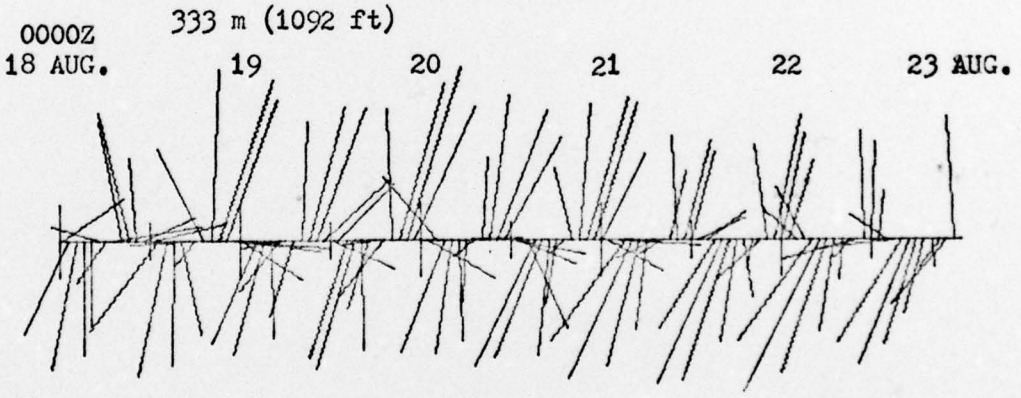

100 m (328 ft)

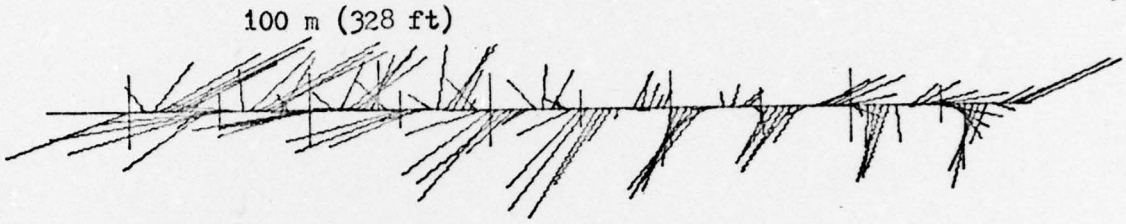

0000Z
8 AUG.
333 m (1092 ft)
9
10
11
12
13 AUG.

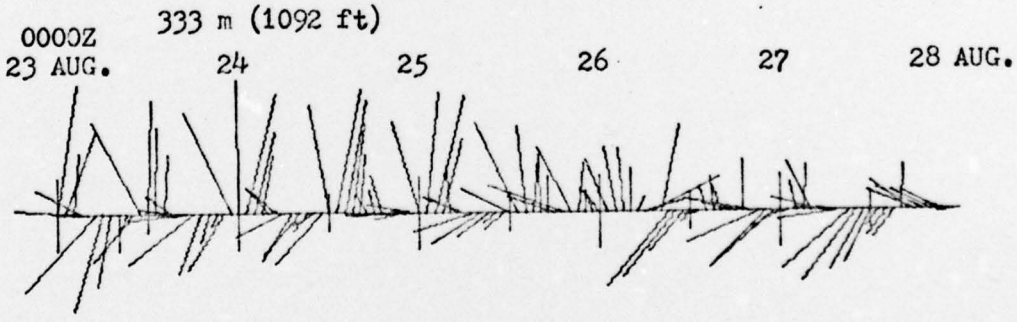

100 m (328 ft)

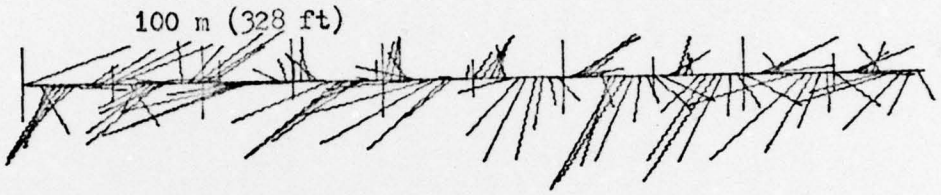

0000Z
13 AUG.
333 m(1092 ft)
14
15
16
17
18 AUG.

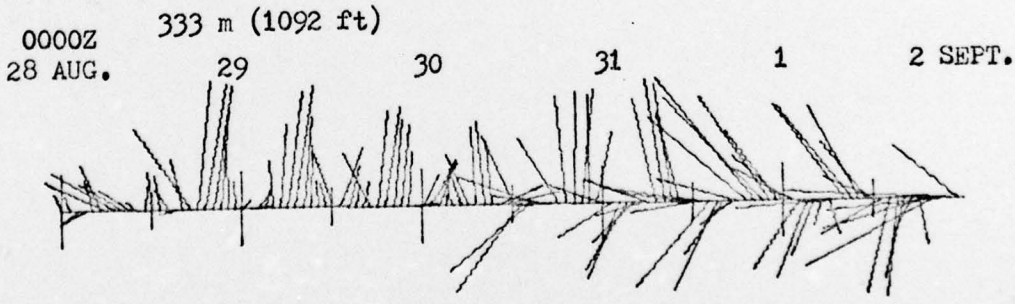

100 m (328 ft)


333 m (1092 ft)
0000Z
18 AUG.
19
20
21
22
23 AUG.


100 m (328 ft)


333 m (1092 ft)
0000Z
23 AUG.
24
25
26
27
28 AUG.


100 m (328 ft)


333 m (1092 ft)
0000Z
28 AUG.
29
30
31
1
2 SEPT.

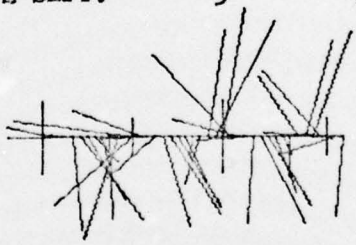
100 m (328 ft)

0000Z
2 SEPT.

333 m (1092 ft)

3

4 SEPT.



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